



Appendix L

Hybrid AM IBOC Field Performance *Audio Quality in Strong Signal Conditions*

Purpose of Test

The objective of the Strong Signal Quality Test was to compare the audio quality of iBiquity's Hybrid AM IBOC system and existing analog AM broadcasting in unimpaired, real world reception conditions. The test was designed to capture general population listeners' impressions of both IBOC and analog AM listening experiences close to the transmitter where good quality analog would be expected. Both analog and IBOC audio samples were selected at set distances from the transmitter for each radial. The subjective evaluation scores for each radial were aggregated in order to give an overall listening score for both IBOC and analog for each radial.

General Methodology

The method of identifying and evaluating field audio quality in strong signal conditions was consistent with other IBOC field test subjective audio evaluations:

1. The data analyst identified field test conditions of interest in the field test data along with the SMPTE timecode of the corresponding receiver audio recorded during those targeted conditions.
2. The analyst and a subjective test engineer examined the audio at each target location to ensure the content was suitable for subjective testing. If necessary, target sampling points were adjusted to improve subjective testability, and a final list of target SMPTE timecodes was created to identify audio sample locations.
3. Guided by the target SMPTE timecodes, the subjective test engineer extracted subjective audio samples in *.wav format from the field test audio recordings - usually as 15-second segments. Each *.wav sample was given a Windows/DOS file name that is coded with information identifying
 - a. Sample index
 - b. Source radio station
 - c. Conditions of interest and associated parameters
 - d. Location index, if necessary
 - e. Receiver
 - f. Audio content genre
4. The subjective test engineer assigned audio samples to experiment groups for subjective testing. Appropriate types and numbers of anchor samples were added to each group to create complete subjective experiment sets.
5. The subjective test engineer leveled samples within each subjective experiment group so each sample had the same perceptual loudness as every other sample within the same group.
6. Subjective experiment sample groups were sent to Dynastat for ACR-MOS subjective testing.

All audio samples for the Strong Signal Quality Test were produced using the data and recorded audio from the NRSC Hybrid AM IBOC daytime field tests of station WD2XAM. Two factors made this station particularly well suited to an audio quality evaluation in low interference conditions:

- WD2XAM is located in the Midwest and is subject to no significant 1st and 2nd adjacent channel interference.
- iBiquity had control of program material and was able to use full-length versions of the source audio from which the NRSC laboratory test audio cuts were extracted. These cuts have greater bandwidth and more stereo information than typical of the source material used at most AM stations.

Sampling of Audio for the Strong Signal Quality Test

The data analyst and subjective test engineer selected audio for evaluation in WD2XAM's areas of strong signal reception. For each of the station's test radials, 15-second audio segments were sampled from reception points at 2.5, 5, 7.5, 10, 15 and 20 miles from the transmitter. This produced 36 audio samples for each analog and IBOC receiver. Primary selection of the audio sample points was based solely upon geographical position – not on audio mode or on audio quality. Each 15-second audio sample represented, as closely as possible, the audio received at its corresponding target location. The only other consideration in audio sampling was the program content, which had to be compatible with good subjective testing methodology. To accommodate this requirement, each audio sample was allowed to begin or end within 30 seconds of the SMPTE time corresponding to its targeted location. However, this adjustment was allowed *only* where needed to obtain acceptable program content for subjective testing.

Results

All 36 locations around WD2XAM produced samples with audio content acceptable for subjective testing. Each subjective audio sample began or ended within 10 seconds of the exact SMPTE timecode corresponding to 2.5, 5.0, 7.5, 10, 15 or 20 miles from the transmitter site. All three AM performance field test radios – the iBiquity digital, the Delphi PN 09394139 and the Pioneer KEH-1900 receivers – provided audio samples at each test location. The resulting 108 samples plus anchors comprised a single subjective test group.

In 35 of 36 samples from WD2XAM, the IBOC receiver was in either enhanced or core digital audio mode. At mile 15 on the 180-degree radial, the IBOC receiver was in analog mode for at least part of the sample.

The chart in Figure 1 shows the aggregate ACR-MOS ratings for each receiver by daytime test radial of WD2XAM. As is evident from the figure, in all cases participants rated IBOC performance superior to the performance of the analog receivers. Thus, the test demonstrated that even in areas of high quality analog AM broadcasting, IBOC will provide a noticeable audio quality improvement over analog AM.

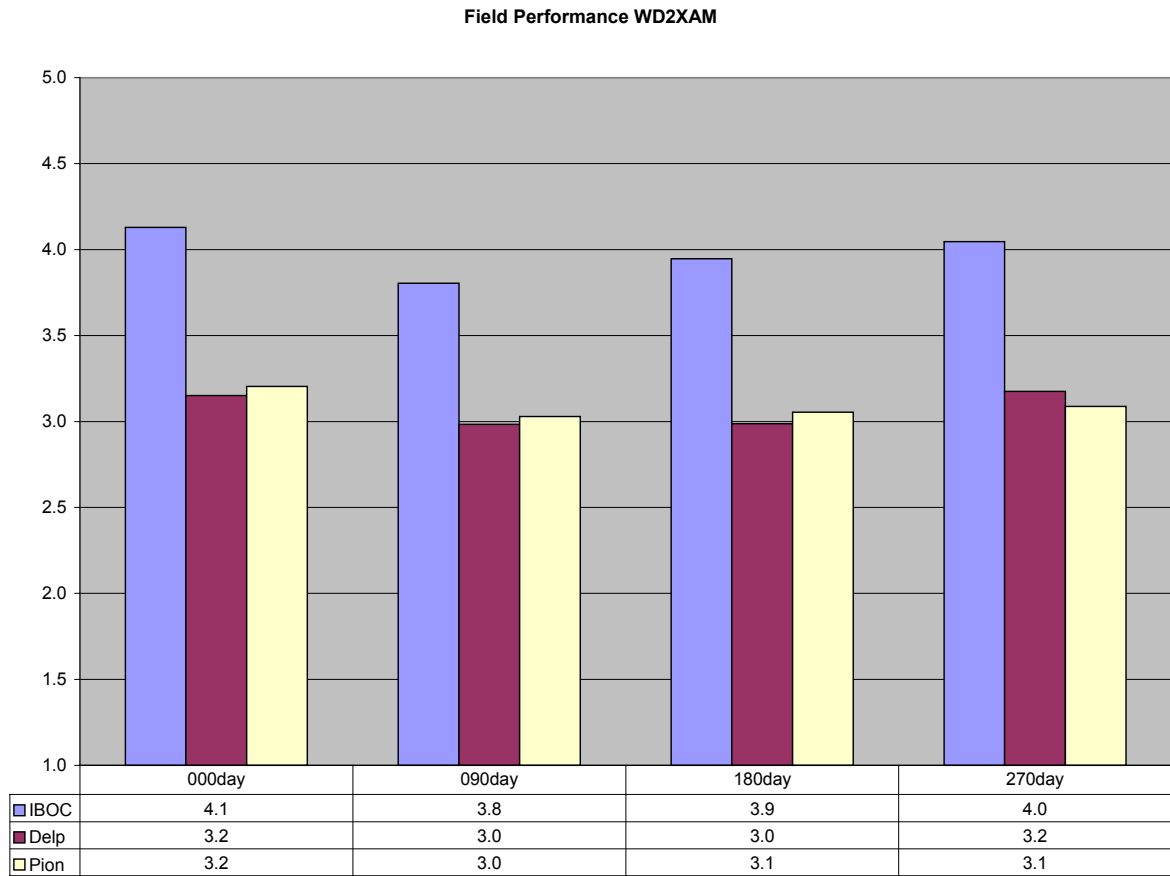


Figure 1: Field Test Audio Quality in Strong Signal Conditions: WD2XAM